

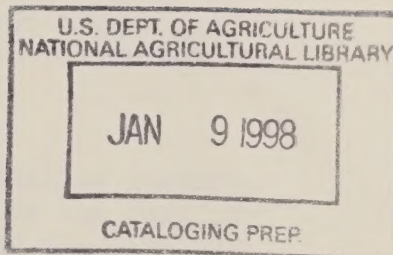
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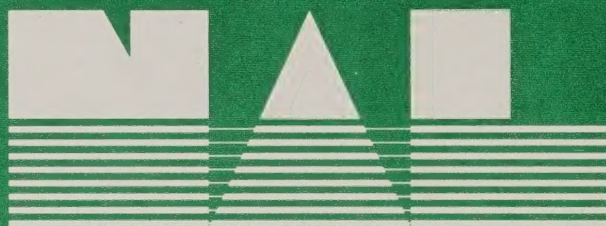
A National Program of Research for

SWINE



Prepared by
A JOINT TASK FORCE OF THE
U. S. DEPARTMENT OF AGRICULTURE
AND THE STATE UNIVERSITIES
AND LAND GRANT COLLEGES

**United States
Department of
Agriculture**



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FOREWORD

The United States Department of Agriculture and State Agricultural Experiment Stations are continuing comprehensive planning of research. This report is a part of this joint research planning and was prepared under recommendation 2 (page 204, paragraph 3) of the National Program of Research for Agriculture.

The task force which developed the report was requested to express their collective judgment as individual scientists and research administrators in regard to the research questions that need to be answered, the evaluation of present research efforts, and changes in research programs to meet present and future needs. The task force was asked to use the National Program of Research for Agriculture as a basis for their recommendation. However, in recognition of changing research needs it was anticipated that the task force recommendations might deviate from the specific plans of the National Program. These deviations are identified in the report along with appropriate reasons for change.

The report represents a valuable contribution to research plans for agriculture. It will be utilized by the Department and the State Agricultural Experiment Stations in developing their research programs. It should not be regarded as a request for the appropriation of funds or as a proposed rate at which funds will be requested to implement the research program.

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This report has been prepared in limited numbers. Persons having a special interest in the development of public research and related programs may request copies from the Research Program Development and Evaluation Staff, Room 318-E Administration Bldg., USDA, Washington, D.C. 20250.

November 1968

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PREFACE

Background

The long-range study, "A National Program of Research for Agriculture," conducted by a joint USDA-SAES Task Force, was published in October 1966. The second recommendation of the study called for a more systematic and continuing mechanism that would facilitate joint research program planning, evaluation, and coordination. The Agricultural Research Planning Committee at its July and December 1966 meetings recommended the establishment of task forces to develop coordinated State-Federal plans for specified areas of research. Subsequently, thirty-two task forces were established of which this is one.

Authority

The Joint Task Force on Swine was established in memoranda of Dr. George L. Mehren, Assistant Secretary of Agriculture, and Dr. R. L. Lovvorn, Chairman, Experiment Station Committee on Organization and Policy, dated March 24, 1967.

Membership

- USDA - R. E. Hodgson, Director, Animal Husbandry Research Division,
Agricultural Research Service - Co-Chairman
Carl F. Sierk, Assistant Administrator, Cooperative State
Research Service
R. D. Shuman, Bacteriological Investigations, National
Animal Disease Laboratory, Ames, Iowa
W. L. Sulzbacher, Chief, Meat Laboratory, Eastern Utilization
Research and Development Division, ARS, Beltsville, Maryland
Roy N. Van Arsdall, Economist, ERS, Urbana, Illinois
- SAES - George M. Browning, Regional Director, North Central
Agricultural Experiment Stations, Iowa State University
Ames, Iowa - Co-Chairman
S. J. Bower, Veterinary Science Department, Purdue University
Lafayette, Indiana
Lee Kolmer, Agricultural Economics, (Extension), Iowa State
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Research Laboratory, Quaker Oats Company, 617 West Main
Street, Barrington, Illinois
Warren Roller, Agricultural Engineering, Ohio Agricultural Research
and Development Center, Wooster, Ohio
- Staff Secretary - Max Hinds, Research Program Development and
Evaluation Staff

Assignment

This task force was asked to review and make recommendations with respect to research pertaining to swine included in the "National Program of Research for Agriculture" under research problem areas 210, 211, 212, 213, 310, 311, 312, 313, 409, 410, 411, 412, 501, 505, and 707.

Preliminary Activities of the Swine Industry Committee

The work of the present joint task force on swine research is a continuation of the effort begun by the Committee of Nine in April 1966. The Committee of Nine is a statutory committee of USDA whose duty is to recommend cooperative regional research projects for approval by the Secretary of Agriculture. At its April 1966 meeting, the Committee of Nine recommended that funds be made available to support a study of the problems of the swine industry and develop recommendations.

A Swine Industry Study Committee comprised of twenty-five industry leaders and research administrators met in Chicago May 27, 1966. The names of participants are shown in Appendix A in the Appendix. Papers on various aspects of the swine industry were presented and discussed. The following subcommittee was then named to develop a priority list of researchable questions and make other recommendations for consideration by research administrators:

George Browning, Chairman
Carl F. Sierk, Secretary
Bernard Collins
R. O. Nesheim
Lee Kolmer
Arval Erickson
C. M. Kincaid

The work of this subcommittee was drawn together in a "Pork Package" which was made available to the present task force. Much of this previous effort has been included in the present report.

SUMMARY

Introduction

This effort is a continuation of work initiated by the Committee of Nine in April 1966. A Swine Industry Committee of 25 members met and formed a subgroup which developed a "Pork Package" upon which the work of this task force has been built.

The swine industry:

- provides about 10% of cash farm receipts
- ranks 3rd among commodity groups
- hog numbers, 84 million in 1944 -- 51 million in 1967
- much improvement in production; market weight at younger age;
less feed per pound of gain; more pigs per litter
- 49% of hogs sold now grade No. 1, compared with 1/3 in 1960
- lard, now a low priced by-product at one time was higher priced than lean meat
- per capita consumption of pork dropped 10 lbs. in the last 20 years, while that of beef went up 40 lbs. and poultry up 18 lbs.
- consumers spent 3% of income for pork in 1920's -- now 1.6%
- processors more decentralized than when terminal markets were at peak

Research perspective:

- losses due to diseases and parasites need research attention
- changes in swine production methods require new research approaches for solutions
- more attention is required to reduce costs in production of hogs with less fat and higher, more uniform quality pork
- marketing research emphasis low and fragmented
- AAPRAC recommended overall marketing study since 1965
- TF recommends a flexible research program

144% increase recommended for entire program

Protection: Goal II

- need to reduce losses from diseases and parasites
- 4 additional SMY's recommended for diseases and parasites transmissible to people -- brucellosis, leptospirosis, erysipelas, tuberculosis, ringworm, anthrax, viral diseases, and trichinosis

174% increase recommended for Goal II

Production: Goal III

- large specialized production units put physical and economic stress on animals
- reproductive problems include fertilization, viable births, and only partial success with artificial insemination
- feed costs represent 2/3 of production costs -- still room for much improvement in efficiency
- environmental stress causes loss of one pig per litter
- wide variation among producers in profitability of swine enterprise as a result of management decisions -- need information on confinement, waste disposal, facilities and equipment, protection from diseases -- with all this knowledge put into a "systems package"
- need to understand why consumer acceptance of pork declined 10 lbs. per capita while that of beef and poultry increased

127% increase recommended for Goal III

Product Development and Quality: Goal IV

- great need for objective and rapid measurement of quality
- quality deterioration hinders use of modern low cost technology in cutting, processing and packaging
- need to identify, measure, and preserve quality
- need to reduce processing costs, improve products, and develop new ones
- need better uses for pig skins and fat

80% increase recommended for Goal IV

Marketing: Goal V

- many imperfections in marketing system
- ideal grades and standards would enhance equity and communication between buyers and sellers
- physical handling, storing, and transporting inefficient in providing consumers with desired products in form, time, place, and proper quality
- price determination more questionable than during period of large volume sales on terminal markets: formula pricing, "yellow sheet", -- does price equate supply with demand?
- market structure -- overbuilt in wrong places -- many small inefficient firms
- economic intelligence for decision making: need for more and better
- consumer preferences: decline in consumption indicates lack of understanding of this
- bargaining power: farmers vs. buyers -- equity

175% increase recommended for Goal V

I INTRODUCTION

In order to make meaningful recommendations regarding a research program for the swine industry, it was believed worthwhile to set forth a bird's-eye view of the industry to view its setting in the national economy and its history.

A. Importance and Nature of the Swine Industry

The swine industry provides about 10% of total cash farm receipts--it ranks third among farm commodity groups. In 1966, cash receipts from the sale of all farm commodities amounted to \$43 billion, of which 57% was from livestock products. A comparison of the leading commodities according to their contribution to farm income shows:

Beef cattle and products	20.3%	Soybeans	5.8%
Dairy cattle and products	16.6%	Wheat	4.6%
Hogs	9.6%	Cotton	3.7%
Poultry and eggs	9.5%	Tobacco	2.8%
Corn	5.8%	Peanut	0.6%

1. Geography of swine production.--About 80% of the Nation's hogs are produced in the North Central States--10% in the South Central States, 8% in the South Atlantic States, and the balance in the remaining states. The top five states are: Iowa, 12 million head; Illinois, 7 million, Indiana, 4 million; Missouri, nearly 4 million; and Minnesota with nearly 3 million.

2. Public services and regulations.--The swine industry operates within a framework of services and regulations that require and offer opportunities for research. Among these services are: inspection and quarantine prevents foreign diseases from entering the U.S. through imports; inspection at public stockyards to control diseases; meat inspection at slaughter plants for meat entering interstate trade; packers and stockyards act to preserve free and open competition for livestock in the marketplace; market news to provide information to buyers and sellers of livestock; and standards and grades to facilitate trading through a common language that describes quality and other product attributes to enable buyers and sellers to establish value differences for varying gradations of quality. (For a brief description of these services see Appendix B.)

B. Historical Trends in the Swine Industry

A century ago there were 34 million hogs in the U. S. The number increased to a peak in 1944 of nearly 84 million and has since declined to 51 million head in 1967.

During the last four decades the percent of total cash receipts from farm marketings from livestock has increased from 53.8% to 57.5% but the proportion derived from the sale of hogs has declined from 24.8% to 16.6%. (See Appendix, Table 1.)

American consumers today enjoy the best and most varied diets in the world for a smaller percentage of their income than ever before. In choosing foods consumers over the last quarter century have purchased less pork per capita while they have shown a preference for beef and poultry. For some reason, this consumer signal which reflects consumer preferences has not been effectively carried back through the marketing system. At least, it has not brought about the right kind of responses from pork producers and marketers that were needed to provide consumers with pork products that could effectively compete with other meats.

Lard, a byproduct of the hog industry, is one of the major food fats. Since hogs are raised for pork, lard output is a function of pork prices and demand for pork rather than for lard itself. Before 1920, prices for lard and for the fat cuts which were readily converted into lard were held up by relatively strong export demand as well as a rather strong domestic demand. In this early period, lard was higher priced than any other pork item but today it has become the cheapest major pork product, bringing only about one-third of the price of most of the lean cuts. During the period from 1951/52 to 1965/66 there was a marked shift in the relative proportions of lard and pork produced from each 100 lbs. of live weight slaughtered. The average yield of lard dropped nearly 25%--conversely, the average yield of pork increased about 11 percent. These changes chiefly reflect improved breeding and feeding practices and the gradual shift to the meat-type hog.

1. Trends in production.--Most of the progress in improved pork has come during the last fifty years. Prior to that time, swine breeding was devoted mostly to maintaining swine breeds. Under the Bankhead-Jones Act swine breeding was given additional support including the establishment of a regional swine breeding laboratory. Information developed has contributed to genetic improvement as well as management. The results have given us hogs that reach market weight two months younger; the amount of feed required for 100 pounds of gain decreased substantially; and more than 1½ additional pigs are saved per litter. More recently, emphasis has been devoted to improving swine carcasses with emphasis on the lean cuts--ham, loin, picnic shoulder, and shoulder butt. Breeding is proving to be an important factor in this improvement. According to recent information 49% of hogs marketed now grade U. S. No. 1 compared with only 1/3 in 1960-61. Typical carcasses of barrows and gilts measure about 1/3 inch longer--meaning leaner hogs.

Hog farmers are specializing rapidly. In 1954, there were 2.4 million farms raising hogs and by 1964 the number had declined to 1.1 million--a drop of 54%. During that period the number of hogs per farm had risen from 19 head to 54. This increase in the size of the swine enterprise required large investments in specialized buildings and equipment. A modern confinement facility, suitably equipped, requires an investment of \$30 to \$35 for each pig to be produced. These improvements create greater efficiency in pork production and bring to the consumer a better, more uniform year-round supply of pork.

Research on diseases of swine has made important contributions. In 1907, a serum was developed that produced immunity against hog cholera which for 135 years had caused losses amounting to millions of dollars to the swine industry. For many years vaccination against hog cholera has protected the swine industry but recent progress makes it possible to look forward to the total elimination of the disease.

Another success story is that of vesicular xanthema. In 1952, the disease appeared in 42 states as a result of feeding contaminated garbage to hogs. By 1956, it had been eradicated.

2. Marketing and processing.--Since World War I, livestock marketing has changed at almost every stage. The vast terminal markets that once handled nearly every livestock sale now operate at part capacity in many places and have disappeared altogether in others. A major change in marketing live animals since World War II has been the accelerating decentralization of procurement. Channels through which hogs move from farmer to packer have become more diverse as the decline of the terminal markets has taken place. The one time "Big Four" packers located in Chicago have been replaced with thousands of auctions, buying stations, and interior processing plants. Packer purchases of hogs on terminal markets dropped from 40% in 1950 to 22% in 1966.

Concentration in meatpacking declined markedly after World War II. In 1947, the largest four companies accounted for 41% of value added by manufacture and by 1963 their share had dropped to 31%. During this period the total number of slaughtering firms rose from 2,000 to 2,800. The declining trend in concentration has been most striking for cattle slaughtering. A different pattern emerged in hog slaughtering. While the share of the largest four firms declined from 41% to 34%, that of the next four as a group rose from 10% to 14%. As a consequence, pork produced by the top eight firms declined only slightly, from 51% of commercial production in 1947 to 48% in 1964.

Detailed data available about federally inspected operations show further aspects of structural change in meatpacking. Livestock slaughtered under Federal inspection has made up more than 80% of total commercial production, and the trend has been rising.

Very few hogs have been government graded, and a high proportion of pork has gone into cured and processed products which have been branded. By the end of 1967, about 9 percent of all beef was being graded according to cutability--on the basis of yield of retail cuts. Cutability grading has only been available for beef since July 1965. Comparable grade standards, based on yield of lean cuts, have been available for hogs since 1950. Yet these have been little used.

3. Consumer aspects.--During the last fifteen years the proportion of the consumer's dollar spent for food has declined from 22% to 18% and for many foods the consumer is getting higher quality, better packaged, and more convenient foods. Consumers are not a passive force in modern U. S. markets. The choices made in retail food stores signal to marketers and hence indirectly to farmers what the preferences are in terms of quality, convenience, and price. In this highly competitive situation, pork has not held its own over the years. Some important shifts in consumer demand for pork have occurred.

In the 1920's, consumers in the United States spent a little over 3% of their income for pork but by 1960 this figure had dropped to 1.6%. Years ago, fat meat was preferred because it was considered more flavorful and an important energy food. Lard was widely used until other shortenings were developed which have been serious competitors. Today's consumer resists fat. This change in preference has influenced the market for pork substantially. During this period of relative decline in the consumption of pork, the consumption of beef and poultry was increasing. During the last two decades, per capita consumption of beef has gone up 40 lbs. and poultry, 18 lbs. while that of pork declined about 10 lbs.

C. Research Perspective and Comments

The 1966 inventory of agricultural research shown in the Summary Table, page 7, indicates that 223 scientist-man-years were devoted to research pertaining to the swine industry. Seventy-one percent of the research was conducted by the State Agricultural

Experiment Stations and 29% by the United States Department of Agriculture. This research effort came under four of the research goals set forth in the National Program of Agricultural Research. The relationship of the swine program to the national program and the research emphasis within goals along with the projected increases for 1977 are as follows:

<u>National Goal</u>	<u>Recommended Increase</u>		<u>Proportion</u>	<u>Percent 1977</u>	
	<u>by 1977</u>		<u>1966 Res.</u>	<u>Increase</u>	
	<u>All Agri. Res.</u>	<u>Swine</u>	<u>on Swine</u>	<u>For Swine</u>	
	<u>% 1/</u>	<u>% 2/</u>	<u>3/</u>	<u>4/</u>	<u>5/</u>
II Protection	77	174	31	37	39
III Production	53	127	51	49	48
IV Product Development and Quality ...	43	80	14	10	8
V Efficiency in Marketing	55	175	4	4	5
TOTAL			100	100	100
1/ National Program of Agricultural Research, page 12.					
2/ Increases within goals recommended by the Joint Committee.					
3/ Calculated from information in Summary Table, this report page 7.					
4/ Recommendations of the Joint Committee.					
5/ Recommendations of the Task Force					

The relationship between the different cost components of the consumer's dollar spent for pork and the amount of research effort devoted to the same components is shown in Appendix Table 3. Although marketing functions contribute 30% of the retail price these activities receive only 15% of the research effort even when allowance is made for research in the other economic problem areas: 506, 507, 508, 509, and 510.

In addition to being low relative to production research, marketing research is highly fragmented. In RPA 505, "Physical and Economic Efficiency in Marketing Swine," 3.4 SMY's are distributed among 27 projects in 16 states with two states having 0.5 SMY each, but all others ranging from 0.1 to 0.4 SMY's. In contrast, one state has 7.1 SMY's on feed efficiency of swine at the same time it devotes 0.5 SMY to swine marketing research.

With a low level of research effort that is highly fragmented, it is natural that information would be limited with respect to certain

marketing problems. The following problems were emphasized by the Swine Industry Study Committee referred to in the Preface of this report: (1) pork product acceptance as measured by consumer preference; (2) merchandising and market development; (3) consumer education; (4) institutional uses of pork where its use has been below the level of home consumption; (5) export markets; (6) communications technology for computing quality and value; (7) the impact of a highly integrated industry upon price structure, price determination, and price reporting; and (8) the effect of live hog futures on vertical integration or contract production.

The Animal and Animal Products Research Advisory Committee repeatedly since 1965 has recommended an overall study of livestock marketing. It called attention to the complex nature of livestock markets and the fact that livestock marketing and processing facilities are becoming more decentralized during a period when most marketing and processing operations for other agricultural products are becoming more centralized. The Committee recommended a study that would encompass historical, geographical, technological, and economic developments of the livestock and meat production-marketing complex. To be of maximum value it should be conducted simultaneously throughout the country and encompass all the marketing activities from producer to consumer. Such an undertaking would be a real challenge to State and Federal research administrators and scientists but is only in keeping with the needs of the times.

Finally, the task force recommends keeping the research program flexible so that projections made in this report can be adjusted through future planning and budgeting when new developments occur.

Each research problem area assigned to the Swine Task Force is treated individually in the following sections of this report. The Summary Table on the next page shows the recommendations of the Task Force in terms of scientist-man-years for each research problem area assigned.

JOINT TASK FORCE ON SWINE RESEARCH
Summary of Inventory and Recommended SMY's

Research Problem Area	1966 1/		1972 2/		1977 2/	
	SAES	USDA	SAES	USDA	SAES	USDA
210 Control of Insects	1	0	1	1	2	1(2)
211 Control of Diseases	32	22	54	38	95	56
212 Control of Internal Parasites	5	7	12	15	24	25
707 Prevent Disease Transmission	1	1	2	2	6	2
213 Protect from Toxic Chemicals	2	0	2	0(1)	4(5)	5
Subtotal - Protection	41	30	71	56(57)	131(132)	84(87)
310 Reproductive Performance	21	2	23	7	52	10
311 Feed Efficiency	52	2	54	3	61	5(6)
312 Environmental Stress	11	2	13	11(18)	13(22)	3(4)
313 Improved Management Systems	13	3	16	19(33)	23(40)	8(10)
409 Consumer Acceptability	6	2	8	32(29)	39(35)	10(9)
Subtotal - Production	103	11	114	165(183)	188(210)	36(39)
410 New & Improved Meat	5	7	12	6(8)	18(25)	7(9)
411 New & Improved Products	0	14	14	0	14(15)	17
412 Quality Maintenance	4	0	4	6(10)	6(12)	0(2)
Subtotal - Product Development and Quality	9	21	30	12(18)	38(52)	19(21)
501 Grades and Standards	2	0	2	1	3	2
505 Efficiency in Marketing	3	3	6	5	10	8(6)
Subtotal - Marketing	5	3	8	6	13	10(8)
GRAND TOTAL	158	65	223	259(283)	370(407)	165(173)

1/ Inventory of Agricultural Research, Volume I, Table I, June 1967.

2/ A joint committee representing the Experiment Station Committee on Organization and Policy and the USDA reviewed manpower allocations and recommended the SMY's shown without parentheses. The changes recommended by the Swine Task Force are shown in parentheses.

II RESEARCH GOALS AND PROBLEM AREAS

A. Protection of Livestock - Goal II

In the "National Program of Research for Agriculture," the objective under Goal II is to protect forests, crops, and livestock from natural and artificial hazards. With reference to livestock the program would involve seeking basic information on insects, diseases, parasites, and environmental hazards that cause losses in livestock and to develop effective economic means for their control or elimination.

This objective was broken down further into 14 research problem areas of which four were applicable to the swine industry. These four are: RPA 210, Control of Insect Pests; RPA 211, Control of Diseases; RPA 212, Control of Internal Parasites; and RPA 213, Protection from Toxic Chemicals, Poisonous Plants, and Hazards.

In addition, Goal VII, "Consumer Health, Nutrition, and Well-Being" has as one of its objectives the protection of people from insect pests and harmful microorganisms. A research problem area, 707, is applicable to the swine industry. It pertains to the prevention of transmission of animal diseases to people and will be discussed in this section of the report.

CONTROL OF INSECT PESTS OF SWINE

RPA 210

Situation: Ectoparasites (ticks and lice) reduce the productivity of swine. In addition they may also act as vectors in the transmission of disease such as eperythrozoonosis and swine pox. Improved control methods are needed. Present methods are lacking in overall effectiveness, reasonable cost, and safety. Specific pathogen-free (SPF) herds can be maintained free of external parasites if properly managed, but require added capital investments to initiate.

Objective: To reduce or eliminate losses caused by insect pests.

Research Approaches: The required research would best be accomplished by an interdisciplinary approach utilizing veterinarians, animal scientists, husbandrymen, entomologists, and biochemists.

- A. Study the biology of lice and mites of swine.
- B. Determine the nature of resistance of hog lice and mites to insecticides.
- C. Investigate the absorption, metabolism, and excretion of insecticides by lice and mites.
- D. Study the metabolism of insecticides used on swine or in their environment.
- E. Develop information on disease transmission by ectoparasites for use in the prevention and control.

Character of Benefits: Based upon thorough knowledge of the life cycles and processes of ectoparasites affecting swine the benefits could include: (1) total eradication; (2) reduction of pest populations to negligible levels; and (3) reduction of the need for pesticide chemicals with resulting reduction in production costs.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	1	1	2
USDA	0	1	2
Total	1	2	4

CONTROL OF DISEASES OF SWINE

RPA 211

Situation: Diseases are the single most important factor limiting production of pigs through gestation and marketing and can be the final limiting factor to economic success. While losses from some bacterial and viral diseases can be accounted for directly (catastrophic), it should be recognized that insidious losses occur from a decrease in rate of gain as a result of subclinical infections and chronic diseases. Federal inspection records show that abscesses and tuberculosis are the two largest causes for carcass retention and loss of "parts" at the packinghouse. Pneumonia causes more carcass condemnation than any other disease. In recent years, three swine diseases have combined to form a combination known as the metritis, mastitis, agalactia or MMA complex which affect sows and gilts at farrowing time. They may appear separately but usually are seen in combination. Mastitis is an inflammation of the udder, metritis is an inflammation of the uterus, and agalactia means no milk and is typified by an interference in milk secretion.

Objective: To develop more effective methods for prevention and control of swine diseases. To increase number and effective production of pigs farrowed, weaned, and marketed.

Research Approaches:

- A. Investigate the pathogenesis and control of infecting agents that affect the sexually mature sow and boar.
- B. Investigate the predominating agents that affect baby pigs from birth to weaning time and of those after weaning and to marketable age.
- C. Investigate the many agents involved in respiratory and enteric conditions and of specific diseases such as hog cholera, swine erysipelas, brucellosis, tuberculosis and salmonellosis.
- D. Investigate African swine fever and foot-and-mouth disease. Although they are not presently in this country, the potential hazard of these diseases necessitates studying methods of diagnosis and control.

Character of Benefits: A substantial reduction in the incidence of diseases would contribute to a larger supply of "red meat" as well as a greater economic return to the producer and processor.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	32	57	83
USDA	22	38	56
Total	54	95	139

CONTROL OF INTERNAL PARASITES OF SWINE

RPA 212

Situation: Internal parasites cause economic losses to the swine industry both directly and indirectly. Indirect loss is caused by less efficient conversion of feed to animal protein. Direct loss is from death and condemnation of various parts of the swine carcass at the time of slaughter.

Objective: Develop methods to control or eliminate internal parasites in swine.

Research Approaches:

- A. Clarify biotic relationship of swine parasites in the host pig.
- B. Develop more effective methods to diagnose parasitic infestations.
- C. Develop new and improved safe chemicals for combatting parasitism.
- D. Improve biological control methods and management practices.
- E. Develop immunological methods for control of multicellular parasites of swine.
- F. Determine the ability of parasites to act as vectors of other disease agents (bacteria, viruses, and fungi).

Character of Benefits: Improved efficiency in feed conversion, reduction in deaths, and reduction in condemnation of parts of carcasses at time of slaughter.

<u>Research Effort</u> :	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	5	9	17
USDA	7	15	25
Total	12	24	42

PROTECT SWINE FROM TOXIC CHEMICALS, POISONOUS PLANTS,
AND OTHER HAZARDS

RPA 213

Situation: Swine may suffer losses in productivity from atmospheric pollutants and pesticide residues remaining on crops used for animal food. Poisonous plants can cause heavy losses under specific conditions. Various fungi have recently been incriminated as a cause of losses in swine, not only from the estrogenic effect but from hepatotoxic effect of some of the mycotoxins.

Objective: Reduce or eliminate losses caused by toxic chemicals, poisonous plants and other hazards.

Research Approaches: Research on toxic chemicals and poisonous plants as hazards to swine include:

- A. Determine the specific sites and mechanisms of poisoning in order to learn the molecular basis of the phenomena.
- B. Develop the veterinary toxicology of pesticides and other chemicals used directly on or occurring in the environment of swine.
- C. Determine the specific detoxification mechanism and sensitivity of swine to toxic materials as compared with other species of livestock.
- D. Determine the metabolic fate of pesticides and other potentially toxic chemicals likely to be ingested by swine.
- E. Develop management practices that minimize the use of pesticides and other chemicals that leave toxic residues or that reduce the residue level.
- F. Develop guidelines to prevent or alleviate the effects of toxic plants that cause poisoning or deformities of livestock.
- G. Develop methods to combat nuclear radiation hazards to livestock.

Character of Benefits: Toxic materials occasionally cause dramatic losses, but those due to low-grade toxicities usually are of greater economic importance. These losses could be significantly reduced.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	2	4	5
USDA	0	1	2
Total	2	5	7

PREVENT TRANSMISSION OF SWINE DISEASES
AND PARASITES TO PEOPLE

RPA 707

Situation: Transmission of swine diseases to man is a low-risk hazard to the general public but can become a problem for specific occupational groups such as producers and food handlers unless precautionary measures are followed. Although application of results from research has helped to minimize the hazard -- brucellosis, leptospirosis, erysipelas, tuberculosis, ringworm, anthrax, and some viral diseases still pose a threat to human health. Swine may provide a reservoir host for human influenza virus, particularly the Asian type. Trichinosis, still present at low levels in swine, can be a threat to human health and has been a barrier to export sales to some countries.

Objective: Reduce or eliminate swine diseases and parasites that are transmissible to humans.

Research Approaches: The objective can best be accomplished by selecting specific segments of the total problem and concentrating on them.

- A. Develop a better understanding of the mechanism involved in transmission of animal diseases to people.
- B. Develop control programs to prevent transmission of animal diseases to people.
- C. Develop means of eradicating trichinosis from the United States.
- D. Develop improved procedures, equipment, and facilities for use in pork inspection programs.

Character of Benefits: The danger of disease developing in people from swine would be reduced by controlling or eliminating the diseases transmissible to man. The elimination of trichinosis would open up opportunities for increasing exports of pork.

<u>Research Effort:</u>	<u>Inventory</u>		<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>	
SAES	1	4	4	
USDA	1	2	2	
Total	2	6	6	

B. Efficient Production of Livestock - Goal III

In the "National Program of Research for Agriculture" the objective under Goal III is the production of an adequate supply of farm and forest products at decreasing real production costs. Within this objective the research effort would be aimed at (1) developing new strains of plants and animals with the potential for higher economic returns; (2) the development of optimum plant and animal nutrition as well as cultural and management practices; and (3) the selection of enterprises and the kinds, amounts, and combinations of inputs (such as labor, land, breeding stocks, seed, fertilizers, machinery) that will give maximum efficiency in farm and forest enterprises.

The objective was further broken down into 16 research problem areas of which four were applicable to the swine industry; RPA 310, Reproductive Performance; RPA 311, Feed Efficiency; RPA 312, Environmental Stress; and RPA 313, Improved Management Systems.

In addition, Goal IV, "Product Development and Quality" contains a research problem area 409, "The Production of Animals and Animal Products with Improved Consumer Acceptability," which is applicable to the swine industry and is discussed in this section of the report.

Under Goal III we are concerned with the production of an adequate pork supply and its resulting contribution to enhancing the diets and standard of living for millions of Americans. The research will be primarily directed at improved production efficiency which should bring about improved returns to farmers as well as lower prices for consumers.

IMPROVED REPRODUCTIVE PERFORMANCE OF SWINE

RPA 310

Situation: Modern hog production methods such as large confined units, multifarrowing and other technological changes brought about for economic reasons have increased reproductive stress factors and focussed attention on the important role of reproductive performance in efficient swine production. The major reproductive problems which can have an appreciable effect on economic gain include stress, embryonic death, artificial insemination, synchronization of estrus, induced and increased ovulation rate, reduced age at puberty, control of sex, and a lower incidence of infertility in sows. Through further studies of the physiology of reproduction, significant gains can be made toward solving those problems.

Recent developments in the concept of neurohumoral control of pituitary gonadotrophin secretion have focused attention on the effect of exteroceptive factors such as light, temperature, olfactory, and optic stimuli, behavioral stimuli, and nutrition on reproduction. For example, studies have shown that conception during the warmest six months of the year is about 15% lower than in the coolest six months. This results in approximately 1,200,000 repeat matings per year. The lower conception rate increases feed cost, the cost of each pig at birth, and disrupts scheduled multiple farrowing arrangements. This loss alone costs producers \$8 to \$10 million per year.

A major problem in artificial insemination is the development of techniques to preserve sperm cells at low temperature. The effective use of artificial insemination with synchronization of estrus not only would contribute to the solution of reproductive problems but would provide opportunity for maximum use of sires with proven capacity to sire pigs that gain rapidly and efficiently and yield high-quality carcasses upon slaughter.

Only about 80 percent of the sows bred conceive and about 60 percent of the embryos survive to a termination of pregnancy. Sows and gilts produce an average of 15 eggs, yet the average litter size at birth is only 9.4 pigs. This fertilization failure and embryonic loss costs swine producers over \$200 million annually. Basically, the causes of embryonic mortality of swine can be arranged into five major categories: (1) senility of the gametes, (2) genetic or inherited conditions, (3) hormonal imbalances, (4) nutritional imbalances, and (5) disease factors.

Objective: To develop techniques required to make artificial insemination of swine practical; reduce the incidence of embryonic mortality; and generally to improve the reproduction performance in swine.

Research Approaches:

- A. Conduct detailed studies on the physiology, biochemistry, and metabolism of the sperm cell in order to develop a technique for storing sperm cells from boars so that their fertilizing capacity will be retained after storage at low temperatures.
- B. Develop effective procedures for the successful use of artificial insemination in swine.
- C. Determine factors that cause embryonic death by studying environmental and genetic conditions so that application of the information will help insure that fertilized ova will result in living offspring at the time of parturition.
- D. Develop effective methods for synchronization of estrus and ovulation control.
- E. Determine the effect of temperature and humidity on the reproductive performance of both males and females.
- F. Study the effect on reproduction of behavioral and other exteroceptive factors and determine how each type of stimulus exerts its effects on the hypothalamus, the adenohypophysis, and the gonads.
- G. Develop methods for inducing ovulation and increasing the rate of ovulation.

Character of Benefits: The use of artificial insemination will permit maximum use of superior boars. It is reasonable to expect the increased feed efficiency realized from leaner hogs over other hogs would amount to 20 lbs. per hundredweight of gain. At current production levels this could bring about large savings in feed cost alone. Development of leaner hogs would have a favorable impact on consumption of pork.

Through estrous synchronization, multiple yearly farrowing would utilize equipment and buildings more effectively, thereby reducing overhead costs for each pig marketed. Also, it would provide a more uniform supply of hogs for the market to meet the needs of present-day food processing and distributing.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	21	45	55
USDA	2	7	10
Total	23	52	65

FEED EFFICIENCY IN THE PRODUCTION OF PORK

RPA 311

Situation: Feed accounts for approximately two out of every three dollars of pork production costs. During the past 15 years research has provided a basis for a 15 percent improvement in the efficiency of feed utilization and a reduction of one month in average market age. The opportunity remains for further significant improvement in feed efficiency through a continued and expanded research program. Efficiency in use of feed in pork production has not achieved its full potential when compared with that of broiler production.

The basis of improved nutrition must be precise knowledge of nutrient requirements for all stages of the life cycle, composition and biological availability of nutrients of feedstuffs, and the nutrient interrelationship. The use of computers will permit this information to be used to formulate highly efficient rations at least cost for the various stages of swine production. Adequate information on requirements, availability, and interrelationships of amino acid could result in a 20-25% reduction in protein levels required in swine feeds.

Another factor pertains to feed that leaves storage but never gets into the pig because of poorly designed and/or adjusted mechanical feeding systems. Additional engineering research is needed to improve the design of feeders and feeding systems to reduce waste of feed.

Objective: To increase the efficiency of converting feed into pork.

Research Approaches:

- A. Establish more precise estimates of nutrient requirements through digestion and metabolism studies.
- B. Determine composition and biological availability of nutrients, and metabolizable energy.
- C. Determine alternate sources of nutrients.
- D. Determine nutrient relationships
- E. Determine hormonal and nutrient interactions for maintenance and growth.
- F. Study genetic potential for feed utilization and increased growth rate.

- G. Design and develop better feeders and feeding systems to increase the efficiency and decrease the waste presently involved in the movement of feed from storage to the pig's mouth.

Character of Benefits: Improvement in feed efficiency will result from improved nutrition--but also it will reflect genetic improvement, greater reproductive efficiency, reduced disease losses, and optimum environment.

Swine consume approximately 2 billion dollars worth of feed each year. A 10 percent improvement in feed efficiency would appear to be a reasonable goal.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	52	58	70
USDA	2	3	6
Total	54	61	76

ENVIRONMENTAL STRESS IN PRODUCTION OF SWINE

RPA 312

Situation: Stress from the effects of climate, handling and other environmental factors decrease productivity. Extremes in temperature, humidity, and air movement lead to poor feed efficiency, poor gains, reduced resistance to disease and even death losses. Research in the last fifteen years has elucidated the temperature and ventilation requirements of growing and finishing pigs in confinement on solid floor structures.

However, this is only the beginning of the total problem of environmental stress. With the change of swine production to total confinement rearing, often with liquid manure storage in or under the building, new research is needed to identify the conditions of space, temperature, ventilation, waste removal, air purity, and light and sound that minimize environmental stresses. Tolerance to gases from wastes needs to be determined. Some swine producers that finish pigs in confinement over liquid manure pits report a mysterious decrease in rate of gain above 150 lbs. and increased death losses among pigs loaded and transported to market from these facilities.

Conception rate is reduced by about 15% in the six warmest months of the year. Studies are needed to determine the effect of temperature and humidity upon semen production and quality in boars and on conception rate, implantation and fetal development in females. The potential is certainly at least twelve healthy pigs per litter. Presently, litter sizes average about nine or ten with average losses at birth of 2.2 pigs per litter. Some of this loss is undoubtedly due to improper environment for the sow and for the pigs.

More research is needed to clarify stress influences at birth and to reduce this waste. The immediate post-natal environment, particularly temperature, is critical to the piglet. An understanding of the temperature parameters and the consequences of their violation in terms of weakness and death together with knowledge of how to create the proper environment would do much to reduce baby pig losses.

The interaction between disease, sanitation and environmental stress has not been extensively explored. More cooperative studies involving veterinarians, animal scientists, engineers, and economists are needed to even define the scope of this problem.

It is in applied research that problems and solution descriptions can be outlined. But what is needed in this problem area is five or more years of basic research to find facts on which to base a solution description.

In summary, (1) the effect of thermal stress on baby and growing swine is partially known; (2) some effects of thermal stress on breeding and gestating swine are vaguely known; but (3) the effects of such factors as handling, crowding, air pollutants, disease-environmental stress interaction, neo-natal exposure, thermal stress at conception, and implantation are not known.

Objective:

- A. Develop basic information on growth, reproduction, and diseases, as affected by environmental stress, which will enable the increase in feed efficiency during growing-finishing by an extra 5%, and the increase in the number of live, healthy pigs per litter at weaning by two pigs per litter.
- B. Define the functional design for housing, space, ventilation, temperature control, sanitation, and waste disposal that will bring about a system or systems of housing for the entire life span to realize the above goals.

Research Approaches: Research will need to answer three questions - but they must be answered for each phase of the research: (1) growth, (2) reproduction, and (3) neo-natal survival and disease interaction.

- 1. Determine the environmental conditions that impose the minimal physiological stress (es).
- 2. Determine the performance penalties for departure from these conditions either up or down.
- 3. Determine the estimated costs of providing these conditions exactly, as well as providing several definable decrements from the optimum, by several achievable, technologically attainable methods.

Character of Benefits:

- A. An increase in feed efficiency could be expected from better management systems, particularly under intensive operations.

- B. Reduction of environmental stress could result in more baby pigs saved.
- C. Improved environmental conditions should improve reproductive efficiency.
- D. There are opportunities for substantial savings from reducing or eliminating environmental stress-disease interaction.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	11	18	27
USDA	2	4	4
TOTAL	13	22	31

IMPROVED SWINE PRODUCTION MANAGEMENT SYSTEMS

RPA 313

Situation: The research concerns both swine production management systems and the genetic and breeding work aimed at increasing the inherent ability of hogs for desirable production characteristics.

The management decisions made by the hog producer will increasingly be a major factor determining whether the hog enterprise on farms succeeds or fails. Studies have repeatedly shown great variability between producers.

Historically, the management decisions made by hog producers have increasingly been the major factor affecting the success of the hog enterprise on farms. These decisions have involved the use of biological and economic data in an effort to develop optimum and complete production-management systems. Studies of the end results of these entrepreneurial decisions have repeatedly shown great variability. An Illinois study of 702 farms in 1966 showed 123 farms in a high-return group and 108 in a low-return group. The high-return group had returns per \$100 of feed fed that ranged from \$190 to \$209, and for the low-return group from \$140 to \$159. While most of the differences between the groups were caused by differences in feed conversions and in feed costs per 100 pounds produced, systems of care and management also affected the efficiency of production. The high-return farms used 75 pounds less feed to produce 100 pounds of pork--also, they had 0.3 more pigs weaned per litter, 0.3% lower death loss, and 58¢ per 100 pounds higher selling price for pork sold.

The revolutionary changes that have occurred in the broiler industry make it appropriate to ask whether similar changes could occur in the swine industry. With only half as many producers now as 15 years ago, and with the average swine enterprise more than doubled, it seems likely that the swine industry is rapidly moving toward much greater intensity of production. As we visualize our economy and society growing ever more complex with more automation, mass production, and mass distribution--with credit cards replacing currency, with the possibility of consumers ordering groceries from their homes via TV-telephone, and with the possibility of producers selling live animals via televised auction--the pressure will increase for uniformly high quality animals and more efficient production.

Swine producers and others supplying inputs or processing output must face the questions relevant to the future structure of that industry. Do the technologies of the industry permit or inhibit mass, integrated production? Where and by whom will production decisions be made? Will they continue to be made by individual producers or will they emerge from integrated organizations engaged in a factory-type production process. Production

decisions of the future will very likely be directed at producing mass quantities of animals that will yield cuts for retail stores that will be so identical that consumers will be unable to tell them apart--a situation that the broiler industry has already reached.

The competitive nature of such a production process will make research information about the biological-economic relationships increasingly valuable to decision-makers wherever they are. An intensified production process will require more fundamental information on such problems as breeding systems, estrous control, artificial insemination, swine behavior, environmental control, facilities and equipment design, protection against diseases and parasites, and waste disposal. Basic information developed in these various problem areas will need to be integrated into efficient production systems to maximize returns on capital and labor inputs.

The genetic improvement through breeding systems and selection offers promise to increase efficiency and returns to hog producers. Genetic ability is expressed in high fertility; rapid growth rate; feed efficiency; resistance to stress and diseases and parasites; mothering ability in sows; and the characteristics and composition of the carcass tissue. Breeding systems, particularly crossing of breeds and highly selected inbred lines, to utilize non-additive genetic variation and heterosis to achieve maximum expression of economically important biological traits is an important aspect of needed research. Investigations to evaluate selection for desirable traits and correlations among these traits on a full life cycle basis with measurements taken at different stages in the cycle are needed. This research requires use of large numbers of several breeds of swine to accomplish the objectives.

Recent research in the chemistry of body fluids and tissues and in immunology provides new tools to the breeder with which to better evaluate progress. This area of research needs further development and introduction into the genetic research process. These techniques are useful in identifying gene markers and offer opportunity to trace genetic progress and to explain more precisely differences that occur between different lines, strains, and breeds of swine. They may also prove useful in evaluating and predicting economic trait responses to selection and breeding combinations.

Objective: Develop alternative management systems for the production of swine that will integrate and utilize all the applicable knowledge available from the different disciplines that will maximize returns on capital and labor inputs under a wide range of physical and economic conditions. Through breeding and selection and associated physiological and biochemical techniques, find ways to develop pigs that are more productive and more efficient in the production of pork of higher quality and acceptability.

Research Approaches:

- A. Determine the optimum level of intensity of production by studying such factors as numbers, utilization of partial or complete confinement, and substitution of capital for labor.
- B. Obtain more fundamental information on such problems as waste disposal, environmental control, swine behavior, genetic and breeding systems, estrous control, and artificial insemination, facilities and equipment design, and protection against diseases and parasites.
- C. Investigate alternative systems and the resulting costs and returns.
- D. Study such related problems as future markets and the form of business organization.
- E. Develop and test measures of breeding value for sow productivity and efficiency of converting feed into pork protein.
- F. Determine effectiveness of within breed selection among strains, families, and individuals for improving commercial crossbred performance; using the most accurate available measures for components of efficiency in production of pork protein.
- G. Compare specific and rotational crossbreeding methods of evaluating and utilizing domestic and introduced breeds for commercial production.
- H. Estimate importance of epistasis in pig breeding.
- I. Determine relative effectiveness of different methods of breeding for further improvement of specific crossbred combinations.
- J. Study promising research leads in physiology that have a potential for affecting production efficiency--e.g., gene frequencies, marker genes, linkage groups for mapping chromosomes, red blood cells, and serum types.

Character of Benefits: Improvement in management systems can reduce costs and improve efficiency by reductions in labor; reduction in feed usage; reduction in losses due to diseases and stresses. Breeding improvement can result in better type hogs, with greater efficiency in overall production of improved quality pork.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	13	33	40
USDA	3	7	10
Total	16	40	50

PRODUCTION OF PORK AND PORK PRODUCTS
WITH IMPROVED CONSUMER ACCEPTABILITY

RPA 409

Situation: In order for pork to maintain and increase its place in the diet as an important source of protein, it must be made more acceptable to the consumer. The decline in per capita consumption of pork and consumer demand for lean meat indicate that changing the kind and quality of pork is a major problem confronting the swine industry. A concerted research effort towards increased lean production involving genetics, physiology, nutrition, and management could increase the yield of these preferred cuts. An increase in the proportion of lean meat in swine carcasses should help improve consumer acceptability of pork cuts.

Objective: Develop genetic, nutrition, and management procedures for producing hogs capable of efficiently furnishing the attributes in the food products derived from them that meet the preferences and desires of the consumers.

Research Approaches:

- A. Determine the consequences of selection for changing carcass composition on other production traits and on pork quality.
- B. Expand intensive genetic and selection experiments toward increased lean production with detailed studies of the resultant effects on reproduction, growth rate, and pork quality traits such as tenderness, flavor, juiciness, aroma, color, marbling, and texture.
- C. Initiate new studies comparing breeds, including exotic breeds, selected strains within breeds, and crosses in their response to nutritional and management systems for increasing the yield of lean pork.
- D. Conduct basic research on the biochemistry, physiology, and metabolism of contrasting genetic stocks within present breeds and strains to characterize the biological attributes of a truly lean pig and develop precise procedures for more effective selection or nutritional and physiological control of lean pork production.

- E. Conduct complementary research to determine the nutritional requirements and to develop more precise rationing of feeds to provide the kinds and amounts of nutrients during different phases of the growing and finishing periods to favor efficient gains, desirable carcass characteristics, and the presence of tenderness, juiciness, and color in the meat.

Character of Benefits: This research will provide the basic information that will permit the swine industry to produce the type of pork that meets consumer preferences. Also, it will provide more precise evaluation of pork carcasses which is essential to the development of meaningful grade standards.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	6	29	35
USDA	2	6	9
Total	8	35	44

C. Product Development and Quality - Goal IV

In the "National Program of Research for Agriculture", under Goal IV, the objective is to expand the demand for farm products by developing new and improved products and processes and enhancing product quality. Within this objective the research effort would be aimed at (1) developing strains of livestock having attributes that meet the preferences and desires of consumers; (2) improvement of production practices, processing methods and marketing procedures so as to preserve or enhance inherent qualities of farm products; (3) development of new and improved products from agricultural commodities by tailoring products to meet customer preferences and by increasing product utility for the consumer per unit of input.

The objective was further broken down into 12 research problem areas of which three will be discussed in this section: RPA 410, New and Improved Pork Products; RPA 411, New and Improved Products from Pigskins and Inedible Hog Fat; and RPA 412, Quality Maintenance of Pork Products During Marketing. RPA 409 pertaining to producing for consumer acceptability is discussed in the previous section.

Much of the research in this goal contributes to the success of other goals. The success of U. S. products in foreign markets depends in part upon their quality. This research contributes to consumer health and well-being. Also it provides basic information for the improvement of grades and standards, and, by increasing the shelf life or by reducing the bulk of products, it reduces the cost of marketing. As product development increases demand and market outlets, it contributes to the level of living and the prosperity of rural communities.

NEW AND IMPROVED PORK AND PORK PRODUCTS

RPA 410

Situation: A large proportion of the pork supply is consumed as a processed product. This applies both to primal cuts (hams, bacons, shoulders, and shoulder butts) which are cured, and to trimmings which are incorporated into sausages and other comminuted products. Thus, to reverse the declining trend in per capita pork consumption, it is essential that products be produced that will better satisfy consumer demand as well as provide a wider range of desirable products. This will result in a more diversified market for hog producers. In addition to improving pork products, new methods need to be devised for handling fresh pork to better fit it to modern marketing techniques.

Objective: Reduce processing costs, improve present products from pork and preserve their quality, and develop new products from pork.

Research Approaches:

- A. Study the biochemical and physical characteristics of pork muscle and its post mortem behavior with respect to the development and maintenance of desirable flavor, texture, and odor.
- B. Improve techniques for pasteurizing, sterilizing, and otherwise preserving fresh pork to insure better keeping quality and more wholesome products for new avenues of distribution and marketing.
- C. Develop new and improved products and new processing techniques. New techniques are needed for combining portions of pork muscle into optimum sized lean products.
- D. Improve the efficiency of the curing and smoking process to improve color fixation and flavor development in pork products.
- E. Develop new and improved engineering and equipment design.
- F. Develop methods of decreasing product weight and bulk to reduce storage, transportation, and distribution costs.
- G. Formulate shortenings with improved nutritional and physical characteristics.
- H. Study the nutrient value of pork and pork products including the nutritional implications of lard and pork fat in the diet.

I. Give special emphasis to soft pork.

Character of Benefits: The development of superior pork products should help the swine industry maintain or increase the proportion of the consumer market for pork.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	5	8	9
USDA	7	17	20
Total	12	25	29

NEW AND IMPROVED PRODUCTS FROM
PIGSKINS AND INEDIBLE HOG FAT

RPA 411

Situation: Inedible byproducts have traditionally contributed significantly to the livestock economy as raw materials for the textile, leather, soap, feed, pharmaceutical, and other industries. These contributions have increased returns to producers and decreased costs to consumers by defraying part of the processor's cost. In the case of swine, new and additional uses for pigskin are needed. In the case of other inedible raw materials, however, new and improved utilization techniques can take advantage of the unique chemical properties of the animal raw materials to produce products of unique value.

Objective: Develop new and improved uses for pigskins and fat, heretofore considered inedible, and other pork byproducts.

Research Approaches:

- A. Development of increased knowledge of the chemical and physical properties of skins and fats.
- B. Development of better methods of handling pigskins for gelatin and edible collagen manufacture, and glands for pharmaceuticals.
- C. Development of fundamental engineering parameters by which improvements can be achieved in processing new and improved products.
- D. Use of crossbonding agents and improved tanning processes to develop new uses for pigskins.
- E. Development of polymers, detergents, lubricants, and chemical intermediates from inedible fats.
- F. Improvements in processing packinghouse wastes to insure feeds of better sanitary quality.
- G. Divert to edible uses much surplus fat now classed as inedible but actually of good sanitary and functional quality.

Character of Benefits: New and improved uses of pigskin in edible products and industrial products would increase returns to the producer and to the processor, and aid the general public as well. Greater use of hog fat in edible channels rather than current use as inedible products would result in higher returns.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	0	0	0
USDA	14	15	17
Total	14	15	17

QUALITY MAINTENANCE OF PORK PRODUCTS DURING MARKETING

RPA 412

Situation: Present methods of identifying, maintaining, and describing the quality of pork products are inadequate. Wholesomeness of a meat carcass and maintenance of meat quality presupposes proper handling, and the slaughter and processing of disease-free animals that are not contaminated with toxic chemical residues. Development of rapid objective methods to detect unwholesome characteristics and deterioration of meat quality would aid regulatory agencies in their consumer protection efforts and would be useful to the meat industry. There is need for research to determine the feasibility of developing electronic devices in the plant to determine and record the quality and meatiness of carcasses. Such determination would provide a more objective method of determining grades and quality and would provide processors and producers with a better basis for determining carcass value. The producer, through the use of video tapes or other pictorial records obtained in the plant at time of slaughter, would have a carcass record which would aid him in planning breeding and feeding programs.

Maintenance of quality during transport and retail store display is necessary for present-day merchandising. Retailers have been faced with problems of rapid color deterioration in fresh pork, which necessitates the cutting and packaging of fresh pork at the retail store location. This situation hinders taking advantage of modern lower-cost technology in meat cutting, processing, and packaging. Effective methods for preserving the "bloom" would permit the cutting and packaging of fresh pork at packing plants where large-scale operations would result in lower costs.

In dealing with meatpackers, retail buyers often have specific terms with respect to product characteristics and delivery conditions. Most retailers will only buy fresh meat that conforms to certain specifications for weight and quality, with the right to reject upon delivery any that fails to meet agreed-upon standards.

A better understanding of the relationship between the physical and chemical properties of muscle and quality is needed. This information can then be used to devise objective methods of measuring the degree of tenderness, juiciness, and flavor in meat cuts. Lighting conditions required to evaluate meat quality need to be defined so that meat quality attributes can be properly assessed.

Finally, there is need for describing the various attributes of quality and the different gradations in terms that are readily understood. This will

make it possible to establish value differences for specified ranges in quality. This type of market communication would permit transactions without personal inspection of the meat.

Objective: To identify, describe, and maintain the quality of pork products.

Research Approaches:

- A. Develop objective methods for identifying quality attributes in pork and its products.
- B. Develop clear and concise terminology for describing the attributes and the different gradations of quality.
- C. Develop methods for preserving the quality of pork in transit, storage, and during retail display.
- D. Determine the feasibility of developing electronic devices for use in processing plants to determine and record the quality and meatiness of pork carcasses.

Character of Benefits: Reduced quality deterioration and product loss during marketing should result from improved methods for preserving quality. Marketing transactions should be facilitated through more accurate description of products and more precise measurement of quality attributes which can be reflected in economic differentials between gradations of quality.

More effective techniques and devices for identifying quality attributes and the presence of anything unwholesome would enable regulatory agencies to more adequately monitor the quality of products and protect consumers.

The development of video tapes or pictorial records of carcasses would provide information that more accurately reflects market value, as well as a basis for producer decisions pertaining to production.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	4	10	12
USDA	0	2	2
Total	4	12	14

D. Efficiency in Marketing Hogs and Pork - Goal V

In the "National Program of Research for Agriculture," the part pertaining to marketing is contained in Goal V, "Efficiency in the Marketing System." Under this broad goal for all of agriculture are the following objectives: (1) to provide farmers with better market guides for making production and marketing decisions; (2) improved quality and availability of production items and services; (3) facilitate distribution of products; (4) improve the quality and availability of products to the consuming public; and (5) reduce the resources required in the transfer of products from farm to consumer.

These objectives were broken down further into ten research problem areas of which two were assigned to this task force. They are RPA 501, Improvement of Grades and Standards; and RPA 505, Physical and Economic Efficiency in Marketing Livestock. The other RPA's, pertain to supply, demand, and price analysis (506); competition (507); domestic market development (508); marketing firm and system efficiency (509); and farmer bargaining power (510). These problem areas pertain to the entire agriculture marketing system of which hog marketing is a part. In using the commodity approach for this report these factors will be dealt with in RPA 505 as they pertain to the marketing of live hogs and pork products.

Our marketing system is imperfect and in a constant state of change. If we had an ideal marketing system, buyers and sellers would have complete knowledge about all the factors affecting their transactions; consumers would be provided exactly what they want; the product quality would be measured by objective methods and described in simple terms; there would be competition between many sellers and buyers so the price would be at an equilibrium level determined by the forces of supply and demand. Producers would know exactly what consumers wanted. Handlers and processors would be able to communicate with each other and with producers and consumers in understandable terminology to describe product attributes; and, prices would reflect value differences of well-defined gradations of quality.

To help improve our marketing system research will be needed on matters ranging from individual transactions at any point in the marketing system to national policy matters including international trade. For example, more refinement in standards and grades would contribute to more efficient pricing and assurance of greater equity in transactions between buyers and sellers. Research indicating trends and needed adjustments would help decision makers in their choices among alternative courses of action that affect the efficiency of production, processing, and marketing. Unlike many

of the other areas of research, economic problems can never be said to be solved in the sense that one finds a cure for a disease. The marketing system is continually changing in response to changes in the economic, social, and technological climate in which it operates. Thus, new problems are continually arising.

IMPROVEMENT OF GRADES AND STANDARDS

RPA 501

Situation: In most transactions between buyer and seller the negotiation has three important elements--quantity, quality, and price. The price is determined by the other two elements. The unit of quantity is usually expressed in terms of weight or volume. The most uncertain element is characteristics of the product that affect its value to the user.

Grades and standards have been designed to describe product characteristics. Many current grades and standards do not accurately describe the characteristics of the product concerned. Like most everything else in nature, meat is a heterogeneous product. It varies greatly according to age, finish and shape or conformation. Grading is a process of sorting a heterogeneous supply of a commodity into smaller, more uniform or homogeneous groupings or units. These groupings should be economically significant--the quality attributes should be such that a price differential can be established.

Standards for barrow and gilt carcasses were first promulgated in 1952 and revised in 1955. Because of the progress made in swine improvement since 1955, the USDA revised the standards for barrows and gilts effective April 1, 1968. The revised grades reflect accurately the improved values of the U.S. pig crop, and are more comparable with grading systems used by some large packers to help producers guide shifts in production. There are no consumer grades for pork. It is believed that developing consumer grades would enhance the consumer image of pork and facilitate market transactions.

Present knowledge is still very limited with respect to the relationship of visible indicators of quality such as finish, conformation, marbling, and age and still more lacking on the invisible attributes that affect consumer acceptability or palatability such as tenderness, juiciness, flavor, aroma, and lean-to-fat ratio. This lack of information and the need for objective measurement of quality offers a real challenge to researchers to develop some means of identifying and measuring the variables. Recent advances in technology and instrumentation offer hope that even such difficult problems as these are not insurmountable.

Objective: To develop and maintain an effective system for communicating throughout the marketing system the relationship between physical attributes of hogs and pork and the economic values for varying gradations of quality.

Research Approaches:

- A. Identify and measure the relative importance of factors influencing the eating quality of pork and develop practical workable, objective measures of these factors.
- B. Determine the association between various physical, chemical, and histological properties of pork and tenderness, juiciness, flavor, and overall palatability.
- C. Evaluate the effectiveness of existing grade standards in terms of serving the needs of sellers and buyers and for reflecting different gradations of quality which affect value and use.
- D. Determine the need for standards and grades for products for which grade standards do not exist. In its 1966 report the National Commission on Food Marketing recommended more consumer grades.
- E. Develop descriptive terminology of grade standards which will characterize the different product attributes so as to facilitate communication between sellers and buyers.
- F. Develop a uniform system of grades recognizing those characteristics which reflect value and affect use.

Character of Benefits: The basic function of grading is to provide information to the parties of the trade so that information about the article being traded is more nearly equalized. Grades are useful when buyers and sellers cannot personally appraise the product characteristics and wish to conclude the transaction on the basis of product description. In addition, grades assist buyers in obtaining product attributes they desire and help sellers obtain appropriate compensation for what they sell. By eliminating the need to personally inspect each purchase it reduces the cost of buying and selling. Much time and energy is devoted to buying and selling hogs and pork and the animals and products change hands a number of times from farm to dinner table.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	2	2	2
USDA	0	1	2
Total	2	3	4

PHYSICAL EFFICIENCY IN MARKETING HOGS AND PORK

RPA 505-A

Situation: Many of the livestock and meat marketing, slaughter, and warehouse facilities occupied today are obsolete and the work methods that can be used in such facilities are antiquated. As a consequence, labor costs are excessive and are increasing. Many firms still occupy facilities designed primarily for handling rail receipts and rail shipments even though the majority of these products today are moved by motortruck. This situation also adds to handling costs. Changes in transportation systems, population growth and shifts, and advancements in technology have brought about changes in the types of facilities--such as livestock auction markets, commercial feedlots, hotel supply houses, and specialty meat processing plants. Engineering and related research is needed to design improved plant layouts, to minimize travel distances and excessive handling and the development of work methods that will permit use of mechanized and automated equipment.

Shrinkage, stress, bruising, and death cause heavy losses during handling and transporting of livestock. There are few major areas of economic and industrial management inquiry where solid research results are more limited than in the field of transportation. It is not surprising that physical distribution has been described as the last great frontier of industrial waste and inefficiency. Transportation costs for the entire food and food products industry have been estimated at 17 percent of total net sales. A transportation authority has estimated that no more than 15 percent of the possible economies in physical distribution are now being realized.

Objective: To bring about the most effective flow of products from farm to consumer beginning with live hogs and ending up with pork products in the form, time, place, and quality most desired by consumers.

Research Approaches:

- A. Determine the most effective methods, facilities, equipment, and cost-reducing systems for handling, processing, packaging, transporting, and distributing hog and pork products, including the type, size, and location of facilities.
- B. Determine the relationship of firm size, and composition of products to marketing and processing costs.
- C. Determine the relationship of equipment design, plant layout, handling methods, storing, and preparing for market on product quality and marketing costs.
- D. Develop new or improved equipment for handling, storing, and preparing pork for sale to improve its quality and reduce marketing costs.

- E. Determine the effect of transportation equipment design and performance and methods of transportation on marketing and processing costs, product loss and end product quality.
- F. Develop packaging and transportation methods and techniques to maintain product quality and reduce transportation costs.

Character of Benefits: Hogs and pork would be handled in the most advantageous manner at the lowest possible cost. Losses of product and quality deterioration would be minimal. Consumers would receive high quality pork at the time, in the form, and at a place desired by them.

<u>Research Effort:</u>	<u>Inventory</u>	<u>TF Recommendation</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	3	5	8
USDA	3	5	6
	<hr/>		
TOTAL	6	10	14

Note: The above SMY allocation includes 505-B,C,D,E,F.

COMPETITION AND PRICE DETERMINATION FOR HOGS AND PORK

RPA 505-B

Situation: Competition is generally considered a regulator of the economy. Although there are numerous forms of competition, price is a common denominator for expressing it in the market place. When products flow through the marketing system the activities pertaining to physical efficiency discussed under RPA 505A take place simultaneously with pricing activities. Most of the physical activities such as assembly, processing, storing, transporting, and distributing are visible and can be measured in terms of output per unit of input. Many activities affecting price are not visible except when stated in sales agreement or in terms of price but many unseen factors influence the net result. Pricing effectiveness pertains to how well the pricing mechanism gives coordination and direction to the entire production and marketing sequence. How effective the pricing system is depends to a large extent on how rapidly and accurately prices reflect desired weights, grades, quality and number and how rapidly and accurately producers, processors and others can evaluate and act upon this information.

The role of price needs to be evaluated under the changing conditions of integration, formula pricing, specification buying, administered prices, forward pricing, and the decline of terminal markets. The decline of terminal markets has seriously detracted from their usefulness as sources of price information for livestock. Livestock traders are paying increasing attention to dressed meat prices but these markets also, may become too thin to be reliable.

Buyers and sellers of meat have gone increasingly to the use of formula pricing. The greater the volume sold under formula pricing, the less volume there is on which to establish genuine market prices. Prices of products purchased on buyer's specifications are sometimes not quotable. A private market news firm puts out a "yellow sheet" but much controversy surrounds the accuracy and relevance of prices quoted in it and the effect of its price quotations on day-to-day wholesale meat transactions and, in turn on prices to livestock producers.

Competition requires competitors. The number, size, and type of firms and the potential ease of entry of new firms, profoundly affect the competitive environment in which each operates. If effective competition is defined as arriving at prices which reflect actual market supply and demand conditions, it is difficult to determine when this is actually being achieved. In the "old days," livestock arrivals at terminal markets could be counted with a high degree of accuracy but the decentralization of livestock marketing has made it more difficult to determine the supply and demand of livestock on any given day. Ways

must be found to either make competitive pricing continue to function effectively or else find some workable alternative. As marketing continues to decentralize, the effectiveness of price formation, price communication, and resource allocation are expected to decrease unless new procedures are adopted.

There is nothing magic about price determination. Neither buyers nor sellers have perfect market information. This leaves room for possible variations in prices among markets. Added to the problem of efficiency and effectiveness in arriving at equilibrium prices is the associated problem of communicating timely and reliable information about prices. Greater and more accurate product knowledge and market knowledge are needed for this purpose. Pricing and other exchange procedures will require increasing evaluation, considering the key importance they play in allocating resources and distributing income in the changing livestock-meat economy.

Objectives: To evaluate the process of price determination for hogs and pork on a continuing basis to provide information for the purpose of maintaining in the marketing system an equilibrium price reflecting the interaction of the forces of supply and demand.

Research Approaches:

- A. Evaluate the conditions under which prices are arrived at for each transaction from the first assembly point for live animals to the retail purchase by consumers.
- B. Evaluate the effects of integration, formula pricing, specification buying, administered prices, forward pricing, the decline of terminal markets, and other developments that may emerge as part of the marketing system for hogs and pork.
- C. Evaluate the competitive situation with respect to number, size, and type of firm and the entry of new firms to determine whether the competition is viable and effective.
- D. Evaluate the availability of information pertaining to prices of hogs and pork and the communication process by which it is made available to buyers and sellers so that all may be equally and fully informed.
- E. Evaluate the performance of price as a means of guiding production to reduce the cyclical swings that have been a part of the historical pattern of the hog industry.

Character of Benefits: It should be possible to develop an effective pricing mechanism that will guide activities in the swine industry so that optimum resource allocation will result. This should insure an adequate supply of pork to meet the demands of consumers and reward producers equitably for a good job of production and penalize those who do a poor job. Research may be able to develop formulas that will provide efficient and equitable treatment in cases where traditional pricing methods become obsolete.

NOTE: The allocation of SMY's is included in the statement pertaining to RPA 505A.

MARKET STRUCTURE AND OPERATION FOR HOGS AND PORK

RPA 505-C

Situation: Not only is our marketing system imperfect, it is very complex. Aspects of its operation involve the efficiency of individual firms; competition among firms; bargaining power of farmers; the role of consumers; and the overall effect of transportation, location of processing, and interregional competition. These components are researchable elements of the marketing system. Also, we can look at marketing as a flow of products from farm to consumer--in which there are "activity stages" or functions such as: (1) assembly and sale of live animals; (2) processing; (3) storing; (4) pricing; (5) market information; and (6) retail distribution.

When we look at the changes in marketing that have occurred since World War II it is obvious that many millions of dollars invested in terminal market facilities in Chicago and other large terminals have been shifted to other markets. This kind of transfer of resources is costly and ultimately comes out of producer returns or from higher prices to consumers or from capital losses on the part of processors or investors. Reliable research information can be useful in guiding resource allocations in the future.

Apropos this situation, the Animal and Animal Products Research Advisory Committee in 1965 and each year since has made the following recommendation:

"Overall Study of Livestock Marketing. The economic structure of the nation's livestock and meat production-marketing complex is in the midst of great change. Livestock marketing and processing facilities are becoming more decentralized during a period when most marketing and processing operations for other agricultural products are becoming more centralized. Large multispecie packing plants, located in major industrial centers, are being replaced by efficient specialized plants located in livestock production areas.

"Very large sums of money are now invested in the present structure of livestock marketing and processing which handles a portion of our food supply equivalent to about half the value of consumer expenditures for food. There has been a great proliferation of packer and processor buying operations, markets, market agencies, and dealers in the assembly of livestock. The great numbers of these, many not providing either adequate or economical service, represent inefficiencies and high cost. Because of the changes occurring in this very important segment of the U. S. economy, all those concerned with it from producer to consumer need information that will guide them in making future decisions.

"A benchmark study is needed that would encompass historical, geographical, technological, and economic developments of the livestock and meat production-marketing complex. This study could provide information on costs and services rendered by the various components of the marketing system which would help explain the influence of various factors that have contributed to the changes. It should be conducted simultaneously throughout the country and encompass all the marketing activities from the producer to consumer."

Objective: To provide information about the historical, geographical, technological, and economic development of the livestock and meat production-marketing complex as a basis for decision making in the future.

Research Approaches:

- A. Conduct a nationwide study of the livestock and meat production-marketing complex to obtain the information requested in the Advisory Committee recommendation.

Character of Benefits: The hog and pork marketing system is plagued with numerous small relatively inefficient and high cost operating units. Reliable research information should help to bring about a reduction in the number of such units. Based on experiences of the last quarter century, information leading to better business decisions should save untold millions of dollars in the next quarter century.

NOTE: The allocation of SMY's is included in RPA 505A.

SUPPLY, DEMAND, AND PRICE ANALYSIS FOR HOGS AND PORK

RPA 505-D

Situation: This statement represents the commodity approach to RPA 506.

In order for decision-makers in the swine industry to make sound and accurate judgments a great deal of information is needed about the relationship of the swine industry to the rest of the economy and the world. Producers, processors, distributors, and consumers need information based on accurate quantitative knowledge of the interrelationships among prices, production and consumption of farm products, and other factors. Similarly, Congress and the administrators of farm programs need such economic information to evaluate existing and alternative programs or policies in terms of their probable impact on production, consumption, and prices at both the farm and retail levels. The typical farmer as well as most other entrepreneurs in the swine industry cannot afford to collect and analyze all the statistical and economic information necessary for making sound production and marketing decisions.

Important shifts have been occurring in the demand for meat and poultry products--to date the shifts have been unfavorable for pork, however, economic conditions and consumer preferences can change. The decennial household food consumption surveys provide regular benchmarks for analysis of pork consumption in relation to other meats, fish, and poultry, as well as substitutes.

Objective: To provide a continuous flow of information based on analyses of factors affecting the supply, demand, and price, of hogs and pork upon which entrepreneurs in the swine industry can make sound decisions.

Research Approaches:

- A. Develop a national forecasting model for analyzing production adjustments, and for estimating monthly and quarterly supplies, slaughter, prices and demand.
- B. Keep abreast of information available through household food consumption surveys for regular benchmarks and make estimates for interim periods.
- C. Evaluate the effect of substitute meats and other meats on the market for pork.
- D. Evaluate the effect of imports and exports on the swine industry.

- E. Study the phenomena of hog cycles to seek methods of reducing or eliminating their effects.
- F. Provide long-run projections of economic growth and demand and prices.
- G. Evaluate major developments in farming and major changes in national policies and programs.

Character of Benefits: Information on supply, demand, and price analysis along with projections of economic trends and farm income provides the basis for outlook work, policy planning, and farm program appraisal. Such information should bring about more accurate and sound decisions throughout the swine industry--and hopefully a reduction in the swing of the hog cycle or its elimination entirely. Producers can vary their production programs, and meat packers can more accurately plan their labor needs and regulate their inventories. Excessive fluctuations disturb the long-run prosperity of the entire swine industry.

Note: The allocation of SMY's is included in RPA 505-A.

CONSUMER ATTITUDES AND PREFERENCES FOR PORK

RPA 505-E

Situation: Domestic pork consumption depends on the behavior of some 200 million consumers. In our complex marketing economy it has become almost impossible for consumers to discuss their preferences, opinions, satisfactions, and dissatisfactions with producers and marketers. Knowledge of consumer reactions is becoming increasingly important--mistakes in developing, producing, and marketing meat products are costly not only to the farmer but to processors and distributors as well.

An understanding of consumer reactions and the reasons behind them is essential to planning improvements in the production, processing, and marketing of hogs and pork, and for developing educational programs, setting or revising grades or standards, or evaluating new products.

Knowledge of consumer preferences can set in motion a chain-reaction--e.g., the retailer increases his use of grades and standards to describe his specification order from a packer who in turn increases his effort to purchase the kind of animals from producers that will yield the kind of products consumers desire. Producers respond by selecting, breeding, and feeding the kind of animals that meet the specifications of the market as reflected in prices for certain levels of quality for the different products.

Objective: To provide a continuous intelligence service pertaining to consumer attitudes and preferences for pork and other products of the swine industry.

Research Approaches:

- A. Evaluate the knowledge about, and the effect of grades and standards on consumer purchases of pork and other products. This should be cooperative with research under RPA 501.
- B. Evaluate the consumer response to new products, packages, and methods of handling.
- C. Analyze the factors that contribute to pork purchases and to factors that influence consumers to purchase competing products in lieu of pork.
- D. Keep abreast of developments in the by-product market, especially hides and fats.

Character of Benefits: Improved market information upon which to base decisions.

NOTE: The allocation of SMY's is included in RPA 505A.

FARM BARGAINING POWER IN THE MARKETING OF HOGS

RPA 505-F

Situation: This statement represents the commodity approach to RPA 510.

Market power is the ability to influence prices or terms of trade in a way favorable to a business or group. It has long been assumed that, because of the competitive structure of the production process in agriculture, farmers are at a disadvantage in the marketing process and must depend upon competition among buyers to obtain the full value that market conditions justify for their products. Consequently, considerable public enabling legislation has been enacted to strengthen the bargaining and income position of farmers. Examples are the establishment of publicly financed market news, crop and livestock reporting and estimating, and legislation to enable farmers to band together in their buying and selling activities. Farmer cooperatives for years have been involved in helping farmers with problems of bargaining power. Farmers have become increasingly concerned as changes have occurred in the marketing system and they want to participate more. This increased interest has led to self-sponsored programs such as advertising to differentiate their products in the market place. Also Federal and State marketing orders and agreements are longstanding examples of instruments conceived and administered to provide certain elements of bargaining power.

The National Commission on Food Marketing in its 1966 report suggested that there is urgent need for group action by farmers to adjust sales more uniformly, to negotiate with buyers, and to protect themselves against trade practices and abuses of market power to which they are otherwise vulnerable. The costs and benefits of organizing and administering group actions need to be evaluated, as well as the countereffects of these actions on the marketing system and consumers.

Objective: To study and evaluate bargaining power in hog marketing from the standpoint of equity among participating groups.

Research Approaches:

A. Develop a definition of bargaining power--whether it is militant action, organized procedural activity, some passive role, or various combinations of activity.

B. Evaluate the process of transferring ownership between producers and buyers of hogs with respect to the negotiations, including terms, time, place, weights, grades, amount of information available to both parties, and the resulting equity or lack of it.

C. Study and evaluate the need for a more orderly flow of hogs to market in which the need of the meat packer for a steady supply of hogs is related to the decisions of producers with respect to time of sale, weight, and quality of animals.

D. Study and evaluate the need for a third party to assume a larger role in grading and pricing hogs and pork in the marketing process--especially if future market structure incorporates more integration, contracting for future sale, or the emergence of a new form of organizational structure that eliminates points of price determination.

Character of Benefits: The information obtained should provide the basis for equity in the market place for all parties involved.

NOTE: The allocation of SMY's is included in RPA 505A.

APPENDIX A

SWINE INDUSTRY STUDY COMMITTEE

The following participated in a meeting at Chicago, May 27, 1966:

W. R. Bailey, Deputy Director, Farm Production Economics Division, ERS-USDA
Alex Black, Associate Director, Agricultural Experiment Station,
Pennsylvania State University
S. J. Bower, Associate Professor, Veterinary Science, Purdue University
Agricultural Experiment Station
R. W. Bray, Assistant Director, Agricultural Experiment Station,
University of Wisconsin
G. M. Browning, Regional Director, North Central Agricultural Experiment
Stations, Iowa State University
T. C. Byerly, Administrator, Cooperative State Research Service, USDA
Bernard Collins, Swine Producer, Clarion, Iowa
Gerald Engleman, Packers and Stockyards Division, C&MS-USDA
Arval Erikson, Vice President, Oscar Mayer & Co., Madison, Wisconsin
P. R. Hasbargen, Asst. Professor, Extension Farm Mgmt., Univ. of Minnesota
C. F. Kelly, Director, Agricultural Experiment Station, Berkeley, California
E. R. Kiehl, Dean, College of Agriculture, Columbia, Missouri
C. M. Kincaid, Animal Husbandry Research Division, ARS-USDA
Lee Kolmer, Prof. of Marketing, Agricultural Economics & Rural Sociology,
Iowa State University
George L. Mehren, Assistant Secretary, USDA
R. O. Nesheim, Head, Dept. of Animal Science, University of Illinois
John C. Pierce, Livestock Division, C&MS-USDA
L. J. Rafoth, North Central Meat Inspection District, C&MS-USDA
Cecil Robinson, Swine Producer, Route #1, Delaware, Ohio
Carl F. Sierk, Principal Animal Husbandman, CSRS-USDA
H. A. Stewart, Asst. Director, Agricultural Experiment Station,
North Carolina State University
C. H. Thompson, Animal Disease & Parasite Research Division, ARS-USDA
M. J. Tillery, Animal Health Division, ARS-USDA
Roy Van Arsdall, Farm Production Economics Division, ERS-USDA
N. J. Volk, Director, Purdue University Agricultural Experiment Station

APPENDIX B. Brief Description of Public Services and Regulations

a. Animal inspection and quarantine

A national protective system, called Animal Inspection and Quarantine, first established in 1865, guards the U. S. livestock industry by regulating the importation of animals and poultry, animal and poultry products and byproducts, hay, straw, and animal casings--the primary objectives being to keep out foreign diseases that might imperil our livestock industry.

b. Inspection at public stockyards

Federal inspection is a service provided at public stockyards located in the major marketing centers throughout the United States. Since its establishment in 1890, public stockyards inspection has aided in the control or eradication of many serious animal plagues. Federal inspectors examine all livestock arriving at public stockyards, segregate diseased animals and see to it that they are safely disposed of, supervise cleaning and disinfection of vehicles, pens, and premises contaminated by diseased animals, notify State of origin of diseased livestock discovered by inspection, supervise other animal health activities, and issue certificates for interstate movement of livestock found to be apparently free from communicable diseases.

c. Meat inspection

In 1906, Congress enacted the Meat Inspection Act. It requires Federal supervision of the cleanliness, wholesomeness, and labeling of fresh and processed meat food products designated for sale in interstate commerce. Inspection begins with the live animal before slaughter and continues through examination of all parts of the carcass. Supervision is maintained throughout each stage of curing, canning, and other processing.

d. Packers and stockyards act

This Act was passed by Congress in 1921. It was designed to preserve free and open competition for livestock and meat so that each will bring its full and true value in the marketplace. The Act was later amended until it now extends to all country dealers, buying stations, and auction markets if they handle any interstate business. With modern transportation almost all business has become subject to the Act. In 1940, 199 markets in the U. S. were posted and in 1950, 308, and by 1961 this number had grown to over 2,200.

e. Market news

Reporting of wholesale meat markets was initiated at Boston, New York, and Philadelphia in 1917. The next year the first livestock market news reports were issued at Chicago. This service has grown into a major informational aspect of marketing work to provide quick, accurate reporting of market conditions for the benefit of farmers, distributors, and consumers.

f. Standards and Grades

The Secretary of Agriculture is authorized to develop and improve standards of quality, condition, quantity, and grade in order to encourage uniformity and consistency in commercial practices. He is also authorized to inspect and certify the class, quality, and condition of agricultural products so that they may be marketed to best advantage, that trading may be facilitated, and that consumers may be able to obtain the quality product they desire. The first standards for pork were promulgated in 1952. They were revised in 1955 at the suggestion of industry to more adequately reflect the increased demand for pork with less fat. Since then the swine industry has made great progress and USDA revised the standards for barrows and gilts effective April 1, 1968.

APPENDIX TABLE 1. Relationship Between Total Cash Receipts from Farm Marketings and Income from the Sale of Hogs 1/

Year	Total : Receipts from : Farm Marketings	Cash Receipts : from Marketing : Livestock Products	% of : Total from : Livestock	Cash : Receipts : from Hogs	% of : Total from : Hogs	% of : Livestock : from Hogs
	\$ Mil.	\$ Mil.		\$ Mil.		
1926	: 10,558	: 5,683	: 53.8	: 1,407	: 13.3	: 24.8
1936	: 8,391	: 4,742	: 56.5	: 991	: 11.8	: 20.9
1946	: 24,802	: 13,786	: 55.6	: 2,917	: 11.8	: 21.2
1956	: 30,401	: 16,363	: 53.8	: 2,638	: 8.7	: 16.1
1966	: 43,219	: 24,835	: 57.5	: 4,120	: 9.5	: 16.6

1/ Source: Farm Income Situation, No. 207, July 28, 1967, pages 52 and 54.

APPENDIX TABLE 2. Meat Consumption and Expenditures - Per Capita

		B E E F		P O R K		C H I C K E N
		: 1948 : 1958 : 1966		: 1948 : 1958 : 1966		: 1948 : 1958 : 1966
Carcass Weight	Lbs.	: 63.1 : 80.5 : 103.7		: 67.8 : 60.7 : 58.1		: : :
Retail	Lbs.	: 49.8 : 63.6 : 76.7		: 59.2 : 54.0 : 54.0		: 18.3 : 28.3 : 36.0
Retail Price	¢	: 67.7 : 75.0 : 84.6		: 61.7 : 64.8 : 73.6		: 59.0 : 37.0 : 41.2
Per Capita Expenditure	\$: 33.70 : 47.70 : 64.89		: 36.50 : 35.00 : 39.74		: 10.80 : 10.47 : 14.83

APPENDIX TABLE 3. Research Emphasis by Components of the Swine Industry

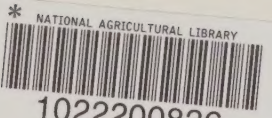
Share of Retail Value According to Components of the Industry	1/ 51%	:	2/ 82%	:	3/ 73%
Production	51%	:	82%	:	73%
Processing	19	:	14	:	12
Assembly, Wholesaling, Transportation, and Other Distribution	6	:	4	:	15
Retailing	24	:	4/	:	
TOTAL ..	100		100		100

1/ Report of the National Commission on Food Marketing, 1966, page 14.

2/ Based on SMY's shown in Summary Table this report, page 7.

3/ Adjusted SMY's by adding to the total for marketing shown in Summary Table an estimate of SMY's in RPA's 506-510 devoted to work applicable to the swine industry, based on the contribution swine makes to the total cash farm income (10% of 310 SMY's).

4/ Agricultural research pertaining to retailing is included in marketing research.



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